CLAIMS: I claim:

1. A machine used for exposure adjustment in digital imaging, comprising:

a. a first set of digital images of a field of view, said first set comprising at least two different digital images, with

i. a first digital image in said first set comprising a first pixel, said first pixel having a first exposure time and said first pixel comprising a first digital number value that represents signal levels of a sensor that responds to visible light

ii. said first digital image in said first set comprising a second pixel, said second pixel having a second exposure time

iii. a second digital image in said first set comprising a third pixel and a fourth pixel

b. arithmetic means for combining said digital images in said first set to produce a composite digital image of said field of view, with

i. said composite digital image having a first composite pixel having a first composite exposure time

ii. said composite digital image having a second composite pixel having a second composite exposure time

whereby said composite digital image can have desired exposure properties that differ from the exposure properties of the digital images from which it is formed.

2. The machine of claim **1** in which said third pixel and said fourth pixel contribute to said first composite pixel, whereby pixels from the same digital image in said first set can contribute to a single pixel in said composite digital image.

3. The machine of claim **1** in which said second pixel and said third pixel contribute to said first composite pixel, whereby pixels from different digital

images in said first set can contribute to a single pixel in said composite digital image.

4. The machine of claim **1** in which:

a. said second pixel contributes to said first composite pixel

b. said first composite exposure time is not identical to said second exposure time

whereby said first composite exposure time is not the same as the exposure times of which it is composed, with possible differences including length, beginning times, and ending times.

5. The machine of claim **1** in which:

a. said first composite pixel is produced using a first arithmetic combining function

b. said second composite pixel is produced using a second arithmetic combining function

c. said first arithmetic combining function is not the same as said second arithmetic combining function

whereby different arithmetic combining functions can be used to produce the composite digital pixels of said composite digital image.

6. The machine of claim **1** further including:

a. means for evaluating exposure properties of said digital images to produce digital image exposure quality estimates

b. means for using said digital image exposure quality estimates to control said arithmetic means for combining said digital images

whereby, when said digital images are underexposed said composite digital image can be made to be properly exposed and not overexposed or underexposed, or, if desired, said composite image can be made to be overexposed or underexposed.

7. The machine of claim **6** in which said arithmetic means for combining said digital images in said first set can provide as said first composite digital image a member of said first set, whereby when said member of said first set has desired exposure properties, said arithmetic means for combining does not have to modify said member.

8. The machine of claim **6**, further including:

   a. means for identifying changes in the relative position of an image feature in said digital images of said field of view

   b. means for modifying said changes in said relative position of said image feature when producing said composite digital image

   whereby such effects as light streaks and motion blur can be compensated for or enhanced in said composite digital image.

9. The machine of claim **1** in which:

   a. one or more members of said first set of digital images of said field of view are acquired in the presence of an active imaging pulse

   b. said active imaging pulse comprises energy in the form of visible light

   c. said machine of claim **1** further includes means for identifying pixels of said digital images which have digital number values representative of reflection of said active imaging pulse from image features in small areas of said field of view, said pixels being identified as pulse image pixels

   d. said arithmetic means for combining said digital images uses said pulse image pixels to produce composite pixels which have digital number values representative of reflection of said active imaging pulse from image features in said small areas of said field of view

   whereby said machine of claim **1** can be used to produce a composite digital image in which said active imaging pulse appears to illuminate a wide area of said field of view, which is useful in digital photography with a flash, where said active imaging pulse is not able to illuminate all areas of said field of view simultaneously.

10. The machine of claim **1** further including:

a. a mobile electric power supply

b. means for powering said arithmetic means for combining with said mobile electric power supply

whereby said machine of claim **1** can be powered by a device such as a battery, a fuel cell, a solar panel, or a generator so that said machine of claim **1** can be moved from place to place and used without a wire-line connection to a non-mobile electric power supply.

11. The machine of claim **1** further including:

a. a second set of two or more digital images of said field of view

b. arithmetic means for combining digital images from said second set to produce a second composite digital image of said field of view

whereby said machine of claim **1** can be used on a sequence of digital images to produce a sequence of composite digital images, whereby said machine of claim **1** can be used to produce a composite digital video sequence with desired exposure properties that differ from those of component digital video sequences.

12. The machine of claim **1** further including means for acquiring digital images, whereby said machine of claim **1** can be part of a digital imaging apparatus such as a digital camera for taking still images or a digital video camera.

13. The machine of claim **12** in which said means for acquiring digital images includes:

a. a sensor with an initial signal level

b. means for exposing said sensor to incident energy during a sensor exposure time, with said initial signal level changing to a final signal level

c. means for representing the response of said sensor during said sensor exposure time as a net signal level proportional to the difference between said final signal level and said initial signal level

d. means for converting said net signal level to a digital number

whereby said means for acquiring digital images uses absolute measurements of the change in signal levels during said sensor exposure time.

14. The machine of claim **12** in which said means for acquiring digital images includes:

a. a sensor with an initial signal level

b. means for exposing said sensor to incident energy during a sensor exposure time, with said initial signal level changing to one or more intermediate signal levels and then to a final signal level

c. means for representing the response of said sensor during said sensor exposure time as a set of one or more net signal levels each proportional to the difference between two of the signal levels in the set consisting of said initial signal level, said intermediate signal levels, and said final signal level

d. means for converting one or more of said net signal levels to digital numbers

whereby said means for acquiring digital images uses differential measurements of the change in signal levels during said sensor exposure time, so that an analog to digital converter with a much smaller input range than the range of the overall sensor signal level change can be used to acquire digital numbers representative of portions of the overall sensor signal level change.

15. The machine of claim **12** in which said means for acquiring digital images includes switched-capacitor means for representing sensor signal levels, whereby, particularly when using differential measurements, high-speed switched-capacitor filtering techniques can enable fast and accurate image acquisition.

16. The machine of claim **12** in which said means for acquiring digital images includes:

a. a first sensor which contributes to said first digital image and not to said second digital image

b. a second sensor which contributes to said second digital image and not to said first digital image

whereby a sensor array can be used to acquire said digital images, such as an array of charge-coupled devices in which a first set of charge-coupled devices produce said first digital image and in which a second set of charge-coupled devices produce said second digital image, with both sets of charge-coupled devices located on the same chip but allowed to respond to incident energy during different exposure times.

17. A method used for exposure adjustment in digital imaging, comprising arithmetic combination of digital images from a first set of digital images of a field of view to produce a composite digital image of said field of view, where:

a. said first set of digital images comprises at least two different digital images, with

i. a first digital image in said first set comprising a first pixel, said first pixel having a first exposure time and said first pixel comprising a first digital number value that represents signal levels of a sensor that responds to visible light

ii. said first digital image in said first set comprising a second pixel, said second pixel having a second exposure time

iii. a second digital image in said first set comprising a third pixel and a fourth pixel

b. said composite digital image:

i. comprises a first composite pixel having a first composite exposure time

ii. comprises a second composite pixel having a second composite exposure time

whereby said composite digital image can have desired exposure properties that differ from the exposure properties of the digital images from which it is formed.

18. The method of claim **17** in which said third pixel and said fourth pixel contribute to said first composite pixel, whereby pixels from the same digital image in said first set can contribute to a single pixel in said composite digital image.

19. The method of claim **17** in which said second pixel and said third pixel contribute to said first composite pixel, whereby pixels from different digital images in said first set can contribute to a single pixel in said composite digital image.

20. The method of claim **17** in which:

a. said second pixel contributes to said first composite pixel
b. said first composite exposure time is not identical to said second exposure time

whereby said first composite exposure time is not the same as the exposure times of which it is composed, with possible differences including length, beginning times, and ending times.

21. The method of claim **17** in which:

a. said first composite pixel is produced using a first arithmetic combining function
b. said second composite pixel is produced using a second arithmetic combining function
c. said first arithmetic combining function is not the same as said second arithmetic combining function

whereby different arithmetic combining functions can be used to produce the composite digital pixels of said composite digital image.

22. The method of claim **17** further including:

a. evalution of exposure properties of said digital images to produce digital image exposure quality estimates

b. using said digital image exposure quality estimates to control said arithmetic means for combining said digital images

whereby, when said digital images are underexposed said composite digital image can be made to be properly exposed and not overexposed or underexposed, or, if desired, said composite image can be made to be overexposed or underexposed.

23. The method of claim **22** in which said arithmetic combining said digital images in said first set can provide as said first composite digital image a member of said first set, whereby when said member of said first set has desired exposure properties, said arithmetic combining does not have to modify said member.

24. The method of claim **22**, further including:

a. identifying changes in the relative position of an image feature in said digital images of said field of view

b. modifying said changes in said relative position of said image feature when producing said composite digital image

whereby such effects as light streaks and motion blur can be compensated for or enhanced in said composite digital image.

25. The method of claim **17** in which:

a. one or more members of said first set of digital images of said field of view are acquired in the presence of an active imaging pulse

b. said active imaging pulse comprises energy in the form of visible light

c. said method of claim **17** further includes identifying pixels of said digital images which have digital number values representative of reflection of said active imaging pulse from image features in small areas of said field of view, said pixels being identified as pulse image pixels

d. said arithmetic combining said digital images uses said pulse image pixels to produce composite pixels which have digital number values representative of reflection of said active imaging pulse from image features in said small areas of said field of view

whereby the method of claim **17** can be used to produce a composite image in which said active imaging pulse appears to illuminate a wide area of said field of view, which is useful in digital photography with a flash, where said active imaging pulse is not able to illuminate all areas of said field of view simultaneously.

26. The method of claim **17** further including powering said arithmetic combining with a mobile electric power supply, whereby the method of claim **17** use for power a device such as a battery, a fuel cell, a solar panel, or a generator so that the method of claim **17** can be used while moving from place to place and without a wire-line connection to a non-mobile electric power supply.

27. The method of claim **17** further including arithmetic combining of digital images from a second set of two or more digital images of said field of view to produce a second composite digital image, whereby said method of claim **17** can be used on a sequence of digital images to produce a sequence of composite digital images, whereby said method of claim **17** can be used to produce a composite digital video sequence with desired exposure properties that differ from those of component digital video sequences.

28. The method of claim **17** further acquiring of digital images, whereby said method of claim **17** can be part of a digital imaging method such as a digital camera method for taking still images or a digital video camera method.

29. The method of claim **28** in which said acquiring of digital images includes:

a. exposing a sensor with an initial signal level to incident energy during a sensor exposure time, with said initial signal level changing to a final signal level

b. representing the response of said sensor during said sensor exposure time as a net signal level proportional to the difference between said final signal level and said initial signal level

c. converting said net signal level to a digital number

whereby said acquiring of digital images uses absolute measurements of the change in signal levels during said sensor exposure time.

30. The method of claim **28** in which said acquiring of digital images includes:

a. exposing a sensor with an initial signal level to incident energy during a sensor exposure time, with said initial signal level changing to one or more intermediate signal levels and then to a final signal level

b. representing the response of said sensor during said sensor exposure time as a set of one or more net signal levels each proportional to the difference between two of the signal levels in the set consisting of said initial signal level, said intermediate signal levels, and said final signal level

c. converting one or more of said net signal levels to digital numbers

whereby said acquiring of digital images uses differential measurements of the change in signal levels during said sensor exposure time, so that an analog to digital converter with a much smaller input range than the range of the overall sensor signal level change can be used to acquire digital numbers representative of portions of the overall sensor signal level change.

31. The method of claim **28** in which said acquiring of digital images includes representing sensor signal levels using switched-capacitor methods, whereby, particularly when using differential measurements, high-speed switched-capacitor filtering techniques can enable fast and accurate image acquisition.

32. The method of claim **28** in which said acquiring of digital images includes:

a. contribution of a first sensor to said first digital image and not to said second digital image

b. contribution of a second sensor to said second digital image and not to said first digital image

whereby a sensor array method can be used for acquiring said digital images, such as an array of charge-coupled devices in which a first set of charge-coupled devices produce said first digital image and in which a second set of charge-coupled devices produce said second digital image, with both sets of charge-coupled devices located on the same chip but allowed to respond to incident energy during different exposure times.